AGU FALL MEETING
San Francisco | 15–19 December 2014

H51E-0660: Characterization of the Water and Energy Cycles in the Agro-Pastoral Sahel from 1950 to 2010, in a Context of Climate and Land-Use Changes

Friday, 19 December 2014
08:00 AM - 12:20 PM
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- ePoster - Leauthaud_H51E.pdf

The water cycle and ecosystem productivity in the Sahel are tightly linked. Combined with land-use changes, modifications in the rainfall regime and climate can have important consequences on local livelihoods, as illustrated by the devastating droughts in the 1980s. Primary production, but also atmosphere dynamics and aquifer recharge, strongly depend on surface-atmosphere interactions. Although the processes underpinning the water and energy cycles at the surface-atmosphere level are starting to be understood, little is known about how they could have evolved in the past 60 years.

This study analyses changes in the water and energy cycles for two major ecosystems (millet and fallow) found in the agro-pastoral Sahel from 1950 to 2010, in a context of strong climate and land-use change. Estimations were undertaken using a process-based Soil-Vegetation-Atmosphere Transfer (SVAT) model (SiSPAT) capable of representing the main surface-atmosphere interactions taking place in the Sahel. Vegetation characteristics were simulated through coupling with vegetation models (STEP and SARRAH) and in-situ data representative of the various ecosystem types. Changes in the rainfall regime induced modifications of the water cycle, both at annual and seasonal time-scales. Different productivities and water seasonal cycles for the millet and fallow systems were evidenced, in accordance with previous studies. When combined with land-use changes, this induced large variations in the water and energy cycles at the landscape scale.

These modifications could have important feedback effects on local climate, which are currently not taken into account in Earth System Models. Future work should also focus on understanding the impact of other drivers of change, such as decreasing soil fertility and increased grazing pressure, on ecosystem productivity and the resulting effects on the water and energy cycles in the Sahel.

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